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RESEARCH ARTICLE

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Contribution to the floristic knowledge of Sillaro, Santerno, and Senio high valleys (Toscana, Italy)

Francesco Roma-Marzio[1,*], Marco D'Antraccoli[1,*], Daniele Angeloni[2], Fabrizio Bartolucci[3], Liliana Bernardo[4], Laura Cancellieri[2], Giuseppe Caruso[5], Fabio Conti[3], David Dolci[6], Giovanni Gestri[7], Leonardo Gubellini[8], Nicole Hofmann[9], Valentina L.A. Laface[10], Edda Lattanzi[11], Paolo Lavezzo[12], Giovanni Maiorca[13], Giulia Montepaone[10], Carmelo M. Musarella[10], Domenico Noto[10], Enrico V. Perrino[14], Elisa Proietti[3], Rizzieri R. Masin[15], Anna Scoppola[2], Adriano Stinca[16], Manuel Tiburtini[6], Agnese Tilia[17], Lorenzo Peruzzi[6,*]

1 *Sistema Museale di Ateneo, Orto e Museo Botanico, Università di Pisa, Via L. Ghini 13, 56126, Pisa, Italy* **2** *Dipartimento di Scienze Agrarie e Forestali, Università della Tuscia, Via San Camillo de Lellis, 01100, Viterbo, Italy* **3** *Centro Ricerche Floristiche dell'Appennino (Università di Camerino - Parco Nazionale del Gran Sasso e Monti della Laga), San Colombo, 67021, Barisciano (L'Aquila), Italy* **4** *Dipartimento di Biologia, Ecologia e Scienze della Terra (DIBEST), Università della Calabria, 87036, Arcavacata di Rende (Cosenza), Italy* **5** *Istituto Tecnico Agrario "Vittorio Emanuele II", Via V. Cortese 1, 88100 Catanzaro, Italy* **6** *Dipartimento di Biologia, Università di Pisa, Via Derna 1, 56126 Pisa, Italy* **7** *Via Bonfiglioli 30, 59100 Prato, Italy* **8** *Centro Ricerche Floristiche Marche, Provincia di Pesaro e Urbino, Via Barsanti 18, 61121 Pesaro (Pesaro e Urbino), Italy* **9** *Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università Politecnica delle Marche, Via Brecce Bianche 10, 60131 Ancona, Italy* **10** *Dipartimento di Agraria, Università Mediterranea di Reggio Calabria, Feo di Vito, 89122 Reggio Calabria, Italy* **11** *Via V. Cerulli 59, 00143 Roma, Italy* **12** *Via Teodosio Macrobio 19, 00136 Roma, Italy* **13** *Agenzia Regionale per lo Sviluppo dell'Agricoltura Calabrese (ARSAC), Viale Trieste, 95 87100 Cosenza, Italy* **14** *Istituto Agronomico Mediterraneo di Bari, Via Ceglie 9, 70010 Valenzano (Bari), Italy 2* **15** *Via Regazzoni Bassa 3, 35036 Montegrotto Terme (Padova), Italy* **16** *Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche, Università della Campania Luigi Vanvitelli, Via Vivaldi 43, 81100 Caserta, Italy* **17** *Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Piazzale A. Moro 5, 00185 Roma, Italy*

Corresponding author: Marco D'Antraccoli (marco.dantraccoli@unipi.it)

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* These authors equally contributed to the paper.

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Abstract

The inventory of the taxa collected during the annual field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society is reported. The field trip was held in 2019 along the Sillaro, Santerno, and Senio high valleys located in Toscana (central Italy). The flora documented for the studied area amounts to 492 specific and subspecific taxa (including five hybrids), belonging to 254 genera and 77 families. *Bromopsis caprina*, *Ophrys appennina*, *O. classica*, *Polygala flavescens* subsp. *flavescens*, and *Pulmonaria vallarsae* subsp. *apennina* were the only five Italian endemics found in the study area, whereas 28 alien taxa were detected. Finally, nine taxa (seven native and two alien) have to be considered as new records for the regional flora of Toscana.

Keywords

Alien species, Apennine, biodiversity, endemics, floristic novelties, vascular flora

Introduction

The working group for Floristics, Systematics and Evolution of the Italian Botanical Society has been active in increasing the floristic knowledge of poorly known areas of Italy (e.g., Bartolucci et al. 2019; Stinca et al. 2019, and literature cited therein). Territories to be investigated have been generally selected based on the low number of published floristic studies, as summarized in the map of floristic knowledge of Italy (Scoppola and Blasi 2005).

Here we present the results of the field trip held in 2019 in Toscana, selecting territories poorly known based also on the analysis of the floristic knowledge reported in the online database Wikiplantbase #Toscana (Bedini et al. 2016; D'Antraccoli et al. 2018; Peruzzi and Bedini 2020+).

Materials and methods

Study area

Seemingly based on the work published by Zangheri (1966), the explored territory partially falls within an area reported by Scoppola and Blasi (2005) as "well known", and partially considered with a "general knowledge". However, according to the Wikiplantbase #Toscana database (Peruzzi and Bedini 2020+), only 327 floristic records, referring to 248 taxa, were reported for this area. About 13% of these records derived from Zangheri (1966), and 50% derived from old historical literature (Caruel 1860–1864; Baroni 1897–1908). Recent floristic data are available for surrounding areas, as Sasso di Castro-Monte Beni (Viciani et al. 2008, 2011, 2012; Peruzzi et al. 2009).

The study area includes the high valley of the rivers Sillaro, Santerno, and Senio, located in the province of Florence (municipalities of Firenzuola and Palazzuolo sul Senio) in the north-eastern part of Toscana, at the boundary with Emilia-Romagna (Fig. 1). The altitude ranges from 250 m a.s.l. at the Santerno river near Castiglioncello

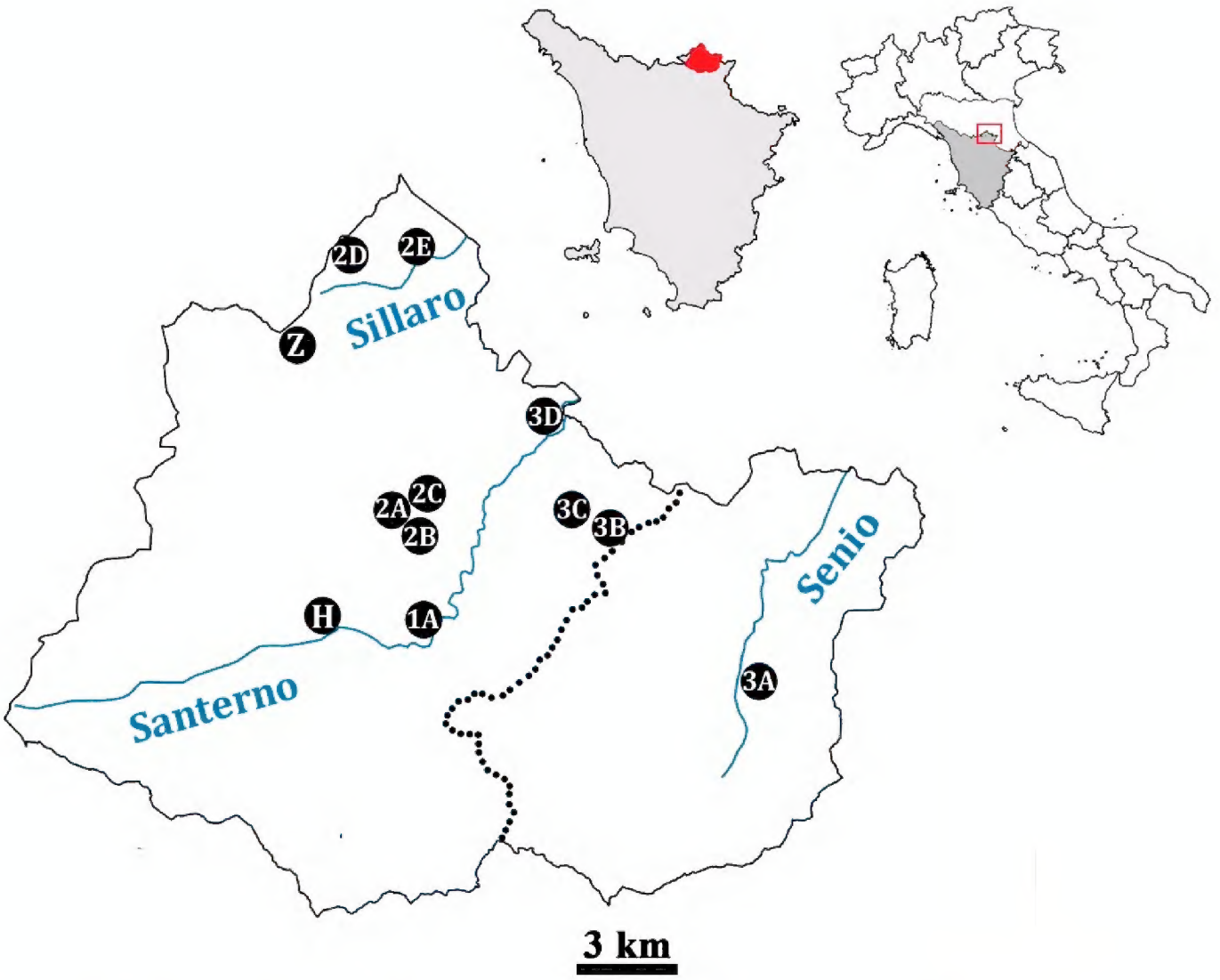

Figure 1. Study area and localization of sampling sites. Dotted line represents the boundary between the municipalities of Firenzuola (westwards) and Palazzuolo sul Senio (eastwards). For details on the sample sites, see Table 1.

to 900 m a.s.l. at Passo del Parietaio. From the geological point of view, the study area is characterized by a marly-arenaceous and marly-limestone (turbidite) sedimentary complex of Medium Miocene, with localized outcrops of ophiolite (Regione Toscana 2019).

According to the classification of Rivas-Martinez et al. (2004) and Pesaresi et al. (2017), the study area is characterized by a temperate continental submediterranean bioclimate, belonging to the vegetation series *Acero obtusati-Querco cerridis sigmetum* (De Dominicis et al. 2010a, b). Indeed, the current forest vegetation is dominated by broad-leaved deciduous trees (mainly *Quercus cerris* L.). Other vegetation types occurring in the study area include rocky areas with therophytic communities, ophiolitic outcrops, pastures with mixed shrubs, badlands ('calanchi') and riparian zones.

Sampling and identification

In order to optimize the sampling, 12 sites were selected basing on 3 criteria: (a) to maximise the environmental heterogeneity among sampling sites, (b) to fall in the less-explored areas according to the available floristic knowledge, and (c) to ensure the sampling representativeness of all the tree valleys (Table 1).

Table 1. List of sampling sites, with reference number, locality name, altitude, main habitat, geographic coordinates and date of collection.

ID	Locality	Habitat	Altitude (m a.s.l.)	Coordinates	Date
1A	Firenzuola (Firenze), Santerno valley, hills east of the village of San Pellegrino	Thermophilous rocky environments, and woods with a prevalence of chestnut	350–530	44°07'16.9"N, 11°25'57.3"E	15 May 2019
2A	Firenzuola (Firenze), Santerno valley, along the pathway CAI 721 from the locality Cerreta to the ruins of the San Biagio alle Piagnole Church	Mixed broadleaved deciduous woods	365–565	44.149328"N, 11.425273"E	16 May 2019
2B	Firenzuola (Firenze), Santerno valley, along the pathway CAI 721 on the north east side of the Mt. Coloreta in the vicinity of the San Biagio alle Piagnole Church	Rocky environments	565–600	44.146741"N, 11.424881"E	16 May 2019
2C	Firenzuola (Firenze), Santerno valley, along the riverbed of the Diaterna torrent in the locality Cerreta	Riverbed and meadows	340–380	44.151941"N, 11.426096"E	16 May 2019
2D	Firenzuola (Firenze), Sillaro valley, Sasso della Mantesca	Ophiolitic rocky environments, shrub formations and pastures	780–860	44.220403"N, 11.396629"E	16 May 2019
2E	Firenzuola (Firenze), Sillaro valley, along the Sillaro torrent, near Piancaldoli	Riparian habitat, meadows and abandoned arable lands	460–480	44.216491"N, 11.428498"E	16 May 2019
3A	Palazzuolo sul Senio (Firenze), Senio valley, along the blue pathway n° 10 from Palazzuolo sul Senio to the ruins of Castellaccio	Mixed broadleaved deciduous woods, clearings and rocky environments	445–585	44.108831"N, 11.546825"E	17 May 2019
3B	Firenzuola (Firenze), Santerno valley, along the street SP32 named "della Faggiola" near the Parietaio Pass	Meadows and pastures	850–900	44.14761"N, 11.49833"E	17 May 2019
3C	Firenzuola (Firenze), Santerno valley, along the street SP32 named "della Faggiola" on the south east side of Poggio Stignano	Pastures, shrub formations and eroded lands (named "calanchi")	700–750	44.14980"N, 11.48833"E	17 May 2019
3D	Firenzuola (Firenze), Santerno valley, along the pathway from the riverbed of the Santerno river to the ruins of Castiglioncello	Ruins, meadows and edges of the forest	250–350	44.175174"N, 11.481944"E	17 May 2019
H	Firenzuola (Firenze), Valle del Santerno, in the locality Contessa Lina in the ground of the Hotel Gli Orzali	Meadows	450–500	44.110387"N, 11.386196"E	15–18 May 2019
Z	Firenzuola (Firenze), Sillaro valley, Sasso di San Zanobi, along the pathway around and on the top of the "Sasso"	Meadows and ophiolitic rocky environments	850–860	44.197493"N, 11.384966"E	18 May 2019

The sites were preliminarily investigated on March 20th–22nd and May 1st 2019 by the organisers, then sampled during the period May 15th–18th 2019 by all participants. A comparative revision of critical collections and of unidentified specimens collected during the field work was carried out at the University of Pisa on February 5th–7th 2020.

The nomenclature of taxa follows the updated checklists of the vascular flora native (Bartolucci et al. 2018) and alien (Galasso et al. 2018) to Italy and subsequent updates summarised in the Portal to the Flora of Italy (2020+; see also Martellos et al. 2020), except for native hybrids, not considered in the above-mentioned checklists. In the floristic list (Suppl. material 1, Part 3), the systematic order of the families follows Bartolucci et al. (2018) and Galasso et al. (2018). Within each family, taxa are ordered alphabetically. For each taxon, after the accepted scientific name, the following information is reported: endemic, cryptogenic and alien status, sampling locality, herbarium in which the collection is conserved (Suppl. material 1, Part 2). Abbreviations or symbols used in the floristic list are: E Italian endemic (according to Peruzzi et al. 2014, 2015; Bartolucci et al. 2018; Portal to the Flora of Italy 2020+); A Alien taxon and its status in Toscana: CAS (casual), NAT (naturalized), INV (invasive)]; C Cryptogenic taxon (doubtfully native taxon, whose origin of occurrence in Italy is unknown); N New record for the flora of Toscana.

Results

During the field investigations a total of 2,860 specimens were collected, belonging to 492 species and subspecies, 254 genera, and 77 families (Suppl. material 1, Part 3), including two native (*Glechoma ×pannonica* Borbás and *Salix apennina* A.K.Skvortsov × *S. caprea* L.) and two alien (*Vitis ×instabilis* Ardenghi, Galasso, Banfi & Lastrucci and *V. ×koberi* Ardenghi, Galasso, Banfi & Lastrucci) hybrids.

Bromopsis caprina (A.Kern. ex Hack.) Banfi & N.G.Passal., *Ophrys appennina* Romolini & Soca, *O. classica* Devillers-Tersch. & Devillers, *Polygala flavescens* DC. subsp. *flavescens*, and *Pulmonaria vallarsae* A.Kern. subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi were the only five Italian endemics found in the study area.

A total of 28 alien taxa were detected of which 5 are casual, 16 naturalized and 7 invasive aliens (*Ailanthus altissima* (Mill.) Swingle, *Artemisia verlotiorum* Lamotte, *Robinia pseudoacacia* L., *Senecio inaequidens* DC., *Veronica persica* Poir., *Vitis ×instabilis* Ardenghi, Galasso, Banfi & Lastrucci, and *V. ×koberi* Ardenghi, Galasso, Banfi & Lastrucci).

Besides *Bromopsis caprina*, eight taxa (six native and two alien) are new for the regional flora of Toscana: *Campanula portenschlagiana* Schult. (casual alien), *Crepis albida* Vill. subsp. *albida*, *Hypochaeris laevigata* (L.) Ces., Pass. & Gibelli, *Potentilla neglecta* Baumg., *P. pusilla* Host (Fig. 2), *Pyrus nivalis* Jacq., *Rumex cristatus* DC. (regional casual alien), and *Taraxacum limosicola* Kirschner & Štěpánek.

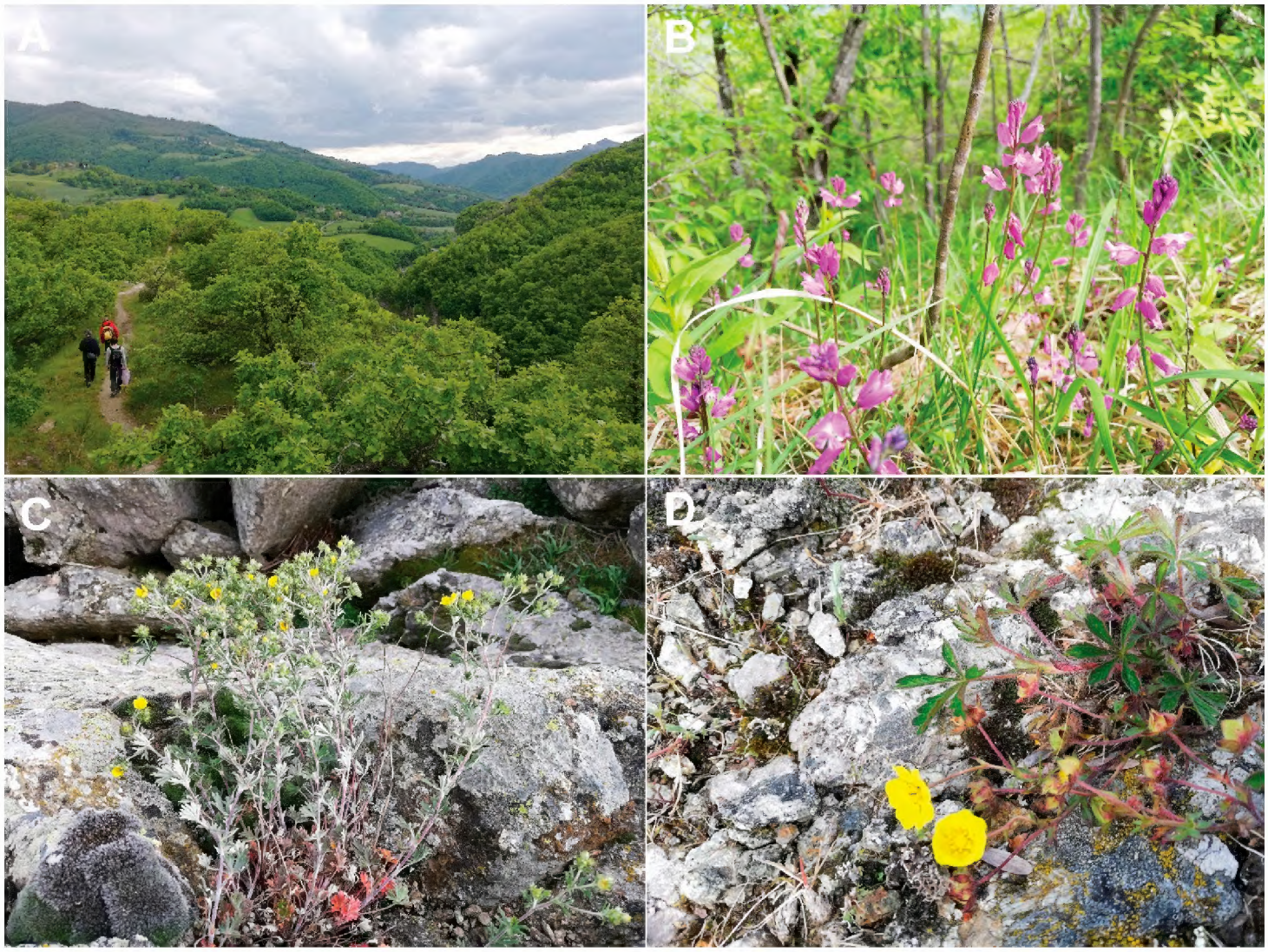

Figure 2. A view from the site 3D in Castiglioncello (Firenzuola, Firenze) (**A**); *Polygala nicaeensis* subsp. *mediterranea* from site 2A (**B**); *Potentilla neglecta* (**C**) and *P. pusilla* (**D**) from site 2D, both new records for the flora of Toscana. For details on the sample sites, see Table 1. All photographs by L. Peruzzi.

Discussion

Among the 492 species and subspecies identified in this work, five are Italian endemics that occur in many other Italian regions, and are included in the Red List of the Italian endemic flora (Orsenigo et al. 2018, 2020) as LC ("Least Concern") with the exception of *Polygala flavescens* subsp. *flavescens*, which is reported as DD ("Data Deficient"). Among them, *Bromopsis caprina* was so far reported only for Lazio, Abruzzo, Campania, Basilicata, and Calabria (Bartolucci et al. 2018). This species was found only in a thermophilous rocky environment at the site 1A.

Concerning the native flora, besides *B. caprina*, six taxa are new for Toscana (Bartolucci et al. 2018). *Crepis albida* Vill. subsp. *albida*, found in the site 1A, reaches in this region its eastern distribution limit, occurring in France, Germany and in Italy only in Piemonte and Liguria (Greuter 2006+; Bartolucci et al. 2018). *Potentilla neglecta* occurs in Italy in Veneto, Trentino-Alto Adige, Abruzzo, and Lazio (Bartolucci et al. 2018, 2019). It was found in the site 2D, growing on ophiolitic rocks. In the same locality, we also collected *Potentilla pusilla*, growing in a pasture with ophiolitic outcrops. This species reaches in Toscana its southern distribution limit, occurring in Italy from Valle d'Aosta to Emilia-Romagna (Bartolucci et al. 2018). *Pyrus nivalis*

was considered as native to Italy by Kurtto (2009), whereas Bartolucci et al. (2018) consider it as cryptogenic in Puglia and non-native in Trentino-Alto Adige. Only few individuals were found in the Santerno Valley (site 3B). Finally, still in site 2D we also collected *Taraxacum limosicola* and *Hypochaeris laevigata*. The former species belongs to *Taraxacum* sect. *Palustria* (H.Lindb.) Dahlst. (Kirschner and Stepánek 1998) and was so far reported only for Emilia-Romagna in Italy, from an area actually close this new locality (Peruzzi and Carlesi 2011). *Hypochaeris laevigata* reaches in Toscana its northern distribution limit, occurring in Sicily, Sardinia, Calabria, Basilicata, and Puglia (doubtful in Campania, Bartolucci et al. 2018). Among native non-endemic flora, *Bellevalia romana* (L.) Sweet, *Colchicum lusitanum* Brot., *Crepis albida* Vill. subsp. *albida*, *Ophrys bertolonii* Moretti subsp. *bertolonii* and *Orchis provincialis* Balb. ex Lam. & DC. are included in the Red List of the Italian flora (Rossi et al. 2013; Orsenigo et al. 2020) as LC.

Concerning *Glechoma ×pannonica*, the occurrence of putatively hybrid populations between *Glechoma hederacea* L. and *G. hirsuta* Waldst. & Kit. in central and northern Italy was already reported by Fiori and Beguinot (1903, under the name *Glechoma hirsuta* var. *heterophylla* (Opiz ex Rchb.) Bég.) and by Zangheri (1976, under the name *Glechoma heterophylla* Opiz). Also, Pignatti (1982) and Pignatti et al. (2018), reported the common occurrences of (unnamed) hybrids where the two parental species co-occur.

Among native species, the following 21 taxa are reported for the first time for the province of Florence (Peruzzi and Bedini 2020+, Roma-Marzio et al. 2016): *Arabis planisiliqua* (Pers.) Rchb., *Asplenium ceterach* L. subsp. *bivalens* (D.E.Mey.) Greuter & Burdet, *Bromopsis stenophylla* (Link) Lazzeri, *Campanula sibirica* L. subsp. *sibirica*, *Carex liparocarpos* Gaudin subsp. *liparocarpos*, *Cerastium brachypetalum* Desp. ex Pers. subsp. *roeseri* (Boiss. & Heldr.) Nyman, *Coronilla vaginalis* Lam., *Crepis taraxacifolia* Thuill., *Galinsoga parviflora* Cav., *Helianthemum croceum* (Desf.) Pers., *Hornungia petraea* (L.) Rchb. subsp. *petraea*, *Lamium hybridum* Vill., *Luzula sylvatica* (Huds.) Gaudin subsp. *sieberi* (Tausch) K.Richt., *Orchis mascula* (L.) L. subsp. *speciosa* (Mutel) Hegi, *Orobanche alba* Stephan ex Willd., *Poa angustifolia* L., *Rosa squarrosa* (A.Rau) Boreau, *Saxifraga exarata* Vill. subsp. *pseudoexarata* (Braun-Blanq.) D.A.Webb, *Silene nemoralis* Waldst. & Kit., *Trinia glauca* (L.) Dumort. subsp. *glauca*, and *Ziziphora granatensis* (Boiss. & Reut.) Melnikov subsp. *granatensis*. In addition, the occurrence of *Rosa pulverulenta* M.Bieb. in the site 2D, represents the first recent finding for Toscana outside Apuan Alps (Peruzzi and Bedini 2020+).

Twenty-eight out of the 492 identified taxa (5%) are non-native. Two of them are new for the flora of Toscana (Galasso et al. 2018): *Campanula portenschlagiana* and *Rumex cristatus*.

Campanula portenschlagiana is native to south-eastern Europe, and it was reported for the first time as alien in Italy for Lombardia (Banfi and Galasso 2010), and later reported as casual for Trentino-Alto Adige, Veneto, Emilia-Romagna, Umbria, and Abruzzo (Galasso et al. 2018). This species grows on an urban wall in the village of Piancaldoli, in the Sillaro valley (site 2E). *Rumex cristatus* is native to Balkans, and it was reported as cryptogenic in Sicily, but as invasive or naturalized alien in several other

Italian regions (Galasso 2008; Galasso et al. 2018). We found only few plants colonizing the edge of a route in the village of San Pellegrino, in the Santerno valley (site 1A).

Among alien species, further four taxa (*Allium shoenoprasum* L. subsp. *schoenoprasum* locally alien, *Alnus cordata* (Loisel.) Duby, *Avena sterilis* L. subsp. *ludoviciana* (Durieu) Gillet & Magne, and *Bromopsis inermis* (Leyss.) Holub subsp. *inermis*), are reported for the first time for the province of Florence (Peruzzi and Bedini 2020+, Roma-Marzio et al. 2016).

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Supplementary material 1

Supplementary data

Authors: Francesco Roma-Marzio, Marco D'Antraccoli, Daniele Angeloni, Fabrizio Bartolucci, Liliana Bernardo, Laura Cancellieri, Giuseppe Caruso, Fabio Conti, David Dolci, Giovanni Gestri, Leonardo Gubellini, Nicole Hofmann, Valentina L.A. Laface, Edda Lattanzi, Paolo Lavezzo, Giovanni Maiorca, Giulia Montepaone, Carmelo M. Musarella, Domenico Noto, Enrico V. Perrino, Elisa Proietti, Rizzieri R. Masin, Anna Scoppola, Adriano Stinca, Manuel Tiburtini, Agnese Tilia, Lorenzo Peruzzi

Data type: species data

Explanation note: **1.** Participants to the field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society (May 15th–18th 2019). **2.** Public and private herbaria in which the collected exsiccata are kept. **3.** Inventory of the taxa collected during the field trip held in May 2019 along the High Valley of Sillaro, Santerno, and Senio (Toscana). **4.** Pictures of selected species and landscapes shot during the field trip held in May 2019 along the High Valleys of Sillaro, Santerno, and Senio (Toscana).

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